## Glenn T. Seaborg Center Special Seminar

# 3rd Annual
# Patricia Durbin Memorial Lecture

## *Plutonium – Moving Back for the Future?*


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*Wednesday, May 9, 2012*
*Refreshments at 3:30 pm*
*Seminar 4:00 - 5:00 pm*
*Bldg. 66 Auditorium (66-317)*


In 1949 the first international tolerance dose for plutonium was agreed by the USA, UK and Canada at the Chalk River Laboratory in Canada. This tolerance dose was established on the back of the known toxicity of radium, the results of early animal studies with plutonium and the first results coming in from the infamous human studies. Later, this tolerance dose was modified, expressed as an activity rather than as a mass, and formalized as a Maximum Permissible Body Burden (MPBB) by the ICRP and NCRP. A corresponding lung burden for inhaled plutonium was also specified. In the years that followed studies were undertaken that described the metabolism and toxicity of plutonium in animal models, which confirmed the lungs, skeleton and liver as important target organs for plutonium-induced carcinogenesis. These were followed by human volunteer studies at the UK Harwell Laboratory. Together, these were used to develop the mathematical models that are now used by both the ICRP and NCRP to set exposure limits - based on notional risk. Two elements of the new radiological protection paradigm that replaced permissible limits were: that alpha particle radiation was 20 times more toxic per unit of energy deposited than low-LET radiations and that risk was linearly related to dose down to zero doses. Evidence will be presented to indicate that both these assumptions are incorrect. First, that there is no fixed toxicity ratio, that for some tumors low-LET radiation is more harmful and that overall a ratio of 2 best fits the data. Secondly, a re-examination of dose response relationships in a wide variety of human and animal studies (all the studies analyzed) indicates the presence of threshold doses, below which no adverse health effects are seen. It would now seem that the dose delivered by the MPBB (40nCi delivering about 100mGy to the skeleton) was below this threshold and that it was adequately protective. This being so it would suggest that the most appropriate way forward is a permissible dose approach for plutonium regulation, without ALARA – effectively moving back for the future.



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